

CLAIMS:

1. A method of material processing, the method comprising the steps of
characterizing a process, said characterizing comprising identifying a signature of said process wherein said signature comprises at least one spatial component;
optimizing said process, said optimizing comprising identifying a reference signature;
comparing said signature of said process with said reference signature for said process, wherein said comparing comprises determining a difference signature, and
determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded.
2. The method according to Claim 1, wherein said performing a process comprises processing a substrate.
3. The method according to Claim 2, wherein said substrate is at least one of a wafer or a liquid crystal display.
4. The method according to Claim 1, wherein said at least one process performance parameter is at least one of etch rate, deposition rate, etch selectivity, etch feature anisotropy, etch feature critical dimension, film property, plasma density, ion energy, concentration of chemical specie, temperature, pressure, mask film thickness, and mask pattern critical dimension.
5. The method according to Claim 1, wherein said plurality of spatial components are Fourier harmonics.
6. The method according to Claim 1, wherein said determining said relationship between said signature and said set of controllable process parameters comprises a multivariate analysis.
7. The method according to Claim 6, wherein said multivariate analysis comprises principal components analysis.

8. The method according to Claim 6, wherein said multivariate analysis comprises design of experiment.
9. The method according to Claim 1, wherein said at least one controllable process parameter comprises at least one of process pressure, RF power, gas flow rate, cooling gas pressure, focus ring, electrode spacing, temperature, film material viscosity, film material surface tension, exposure intensity, and depth of focus.
10. The method according to Claim 1, wherein said improvement comprises an improvement of a spatial uniformity of said scan of data.
11. The method according to Claim 1, wherein said improvement comprises a minimization of at least one spatial component.
12. The method according to Claim 1, wherein said scan of data is a multi-dimensional scan of data.
13. The method according to Claim 12, wherein said multi-dimensional scan of data is a two-dimensional scan of data.
14. A system for material processing, the system comprising
process chamber,
device for measuring and adjusting at least one controllable process parameter,
device for measuring at least one process performance parameter, and
controller, said controller capable of characterizing a process, said characterizing comprising identifying a signature of said process wherein said signature comprises at least one spatial component; optimizing said process, said optimizing comprising identifying a reference signature; comparing said signature of said process with said reference signature for said process, wherein said comparing comprises determining a difference signature, and determining a process fault by comparing said difference

signature with a threshold, wherein said process fault occurs when said threshold is exceeded.

15. The system according to Claim 14, wherein said process chamber is an etch chamber.
16. The system according to Claim 14, wherein said process chamber is a deposition chamber comprising at least one of chemical vapor deposition and physical vapor deposition.
17. The system according to Claim 14, wherein said process chamber is a photoresist coating chamber.
18. The system according to Claim 14, wherein said process chamber is a dielectric coating chamber comprising at least one of a spin-on-glass system and a spin-on-dielectric system.
19. The system according to Claim 14, wherein said process chamber is a photoresist patterning chamber.
20. The system according to Claim 19, wherein said photoresist patterning chamber is an ultraviolet lithography system.
21. The system according to Claim 14, wherein said process chamber is a rapid thermal processing chamber.
22. The system according to Claim 14, wherein said process chamber is a batch diffusion furnace.